Appendix F

Preliminary Hazard Assessment Addendum

ADDENDUM TO THE PRELIMINARY HAZARD ANALYSIS FOR THE AGL NEWCASTLE POWER STATION, TOMAGO NSW - EAST LAYDOWN AREA AT THE NGSF, TOMAGO

Prepared for:	**AGL Energy Limited**
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Addendum to the Preliminary Hazard Analysis for the AGL Newcastle Power Station, Tomago NSW - Temporary Laydown Area at the NGSF, Tomago

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

E1. Introduction

AGL Energy Limited (AGL) proposes to develop a dual fuel power station in Tomago, New South Wales (NSW) (*the Newcastle Power Station*, or *NPS*). AGL is seeking approval for the Project from the NSW Minister for Planning and Environment under the NSW Environmental Planning and Assessment Act 1979.

A Preliminary Hazard Analysis has been prepared to accompany the Environmental Impact Statement for the NPS project, assessing the hazards and risks associated with the project. This Preliminary Hazard Analysis is undergoing review by the NSW Department of Planning, Environment and Industry.

AGL have identified the need to extend the NPS project scope to include a number of construction laydown areas, with one of these (the *East Laydown area*) to be located at AGL's Newcastle Gas Storage Facility (NGSF) site in Tomago, NSW.

Planager has been requested by Aurecon on behalf of AGL to assess the hazards and risks associated with the East Laydown area development and to prepare the present report as an Addendum to the PHA for the NPS project.

The Addendum follows the requirements in the NSW Government's S*tate Environmental Planning Policy No 33—Hazardous and Offensive Development* (SEPP33) and assesses the risks of injury and fatality to people occupying the East Laydown area and the risk from the East Laydown area to the surrounding environment. This is as per the requirements by the NSW Department of Planning, Industry and Environment in their Hazardous Industries Planning Advisory Paper (HIPAP) number 6 - *Hazard* Analysis and their *Multi-Level Risk Assessment Guidelines.* The risk levels are to be compared with the criteria in the Department's HIPAP4 and HIPAP6 for land use planning.

E2. Basis of the assessment

The following commitments to manage hazards and risks form the basis of the hazard and risk assessment of the East Laydown area:

1. The Safety Management System for the NGSF site, which includes the area proposed for use as the East Laydown, will form part of the overall control of the East Laydown area.

2. No potential liquid pollutants are to be stored at the East Laydown areas, i.e. no fuel, lubricants, oils, corrosive liquids etc., and no packages containing environmental pollutant material.

3. The quantities of Dangerous Goods and other potential hazardous and/or pollutant material are to be held at well below the NSW DPIE SEPP33 and the multi-level risk assessment screening and the transportation of Dangerous Goods will be well below the SEPP33 *Transportation Screening Thresholds*.

4. All materials are to be stored as per manufacturer's recommendation, SDS requirements and any relevant Australian Standard and/or Codes of Practice.

5. No transfer of hazardous or pollutant liquids will occur at the East Laydown area.

E3. Results

The results of the Planager assessment demonstrate that East Laydown area is not *potentially hazardous* or *potentially offensive* or associated with *significant risk* as per the definitions in SEPP33 and the Department of Planning, Environment and Industry's multi-level risk assessment. Further, the risk of pollution at the Tomago sand beds is kept to a minimum.

The location of the East Laydown area is considered acceptable from the point of view of adherence to the risk criteria applicable for the NGSF and following ALARP principles, as follows:

Table E1: Summary of the assessment

Aspect of assessment	Requirement	Adherence?
Individual risk of fatality	Risk level at an adjacent industrial area must be below $50x10^{-6}$/year (NSW DPIE, HIPAPs 1 and 4)	The individual risk of fatality for a person located 24 hours per day, 365 days per year at the East Laydown area, is 2.9×10^{-6} per year (2.9 pmpy). This is significantly less than the criterion for industrial areas of 50×10^{-6} per year (50pmpy) and the criterion for individual risk of fatality at the East Laydown area is complied with.
Individual risk of injury	Risk level at an adjacent residential area must be below $50x10^{-6}$/year (NSW DPIE, HIPAPs 1 and 4)	The individual risk of injury for a person located 24 hours per day, 365 days per year at the East Laydown area, is 1.8 x 10-6 per year (1.8 pmpy). This is significantly less than the criterion for residential areas of 50×10^{-6} per year (50pmpy) and the criterion for individual risk of injury at the East Laydown area is complied with.
Societal risk	Risk levels to be kept within negligible area or ALARP must be satisfied (NSW DPIE, HIPAPs 1 and 4)	The societal risk for the occupancy at the East Laydown area is within the negligible risk zone and the criteria for societal risk of fatallity at the East Laydown area is complied with.
ALARP evaluation	The consideration applies to whether a degree of risk increase can be seen as negligible considering its benefits. (NSW DPIE, HIPAPs 1 and 4)	There is minimal impact on then risk profile at the NGSF associated with the proposed East Laydown area. A number of recommendations have been made to further reduce the risk from the Laydown area to the NGSF and vise versa, including ensuring that the East Laydown area is managed to below SEPP33 threshold limits with no storage of pollutant material and, as such, is not considered *Potentially Hazardous.* Further, a number of risks have been eliminated including ensuring no liquid pollutants to be held at the Laydown area. These efforts, together with the adherence to all relevant risk criteria for land use planning, combine to ensure that ALARP principles are met as per NSW Department of Planning, Environment and Industry requirements.

E3. Recvommendations

The following recommendations are made as part of this risk assessment:

Table E2: List of recommendations

Recommendation 1: The NPS Project will need to determine the means with which people accessing the East Laydown area will enter and exit the site at the security gate at Old Punt Road.
Recommendation 2: As the NGSF carpark area can be accessed from the forest tracks surrounding the site, security of the East Laydown area will need to be determined.
Recommendation 3: To ensure that the proposed East Laydown area does not compromise security at the NGSF the NPS Project will need to develop a Security Plan for the East Laydown area and this Plan is to be integrated with the NGSF Security Plan.
Recommendation 4: Regular inspection of the East Laydown area.
Recommendation 5: A Spill/Loss of Containment (LOC) Control Management Plan to be developed for all potentially hazardous/pollutant chemicals to be stored on-site, with spill kits available. In case of a spill, personnel at the East Laydown area to be trained in spill response and, if needed, in initiating the emergency response procedure.
Recommendation 6: Emergency response plan (ERP) applicable for the East Laydown area to be developed and to be integrated with the NGSF ERP.
Recommendation 7: Tactical Fire Plan or other info in the ESIP to be developed for the East Laydown area as per NSWFR requirements.
Recommendation 8: WHS risks to be managed under the NGSF requirements for WHS Management (note that this requirement forms part of a Conditions of Consent for the NGSF site, not just inside the processing area). This needs to include processes such as site Induction, verification and approval of contractor's WHS systems, Management of Change, Permit To Work.
Recommendation 9: The underground high and low pressure natural gas pipelines at the northern side of the site to be physically separated/secured from the East Laydown area, to ensure any weight or vibrations at the underground pipelines is duly managed. Suitable offset to be determined, identified and managed.
Recommendation 10: The emergency alarm at the NGSF will need to be audible also at the East Laydown area to alert persons at the East Laydown of the need to evacuate from the site in case of an emergency at the NGSF.
Recommendation 11: The applicable Asset Management Zone between the East Laydown area and surrounding bushland to be determined to minimise risk of a bush fire.

GLOSSARY AND ABBREVIATIONS

AGL	AGL Energy Limited
APZ	Asset Protection Zone
BLEVE	Boiling Liquid Evaporating Vapour Explosion
DPIE	Department of Planning, Industry and Environment
HAZAN	Hazard Analysis
HIPAP	Hazardous Industry Planning Advisory Paper
LNG	Liquified Natural Gas
MHF	Major Hazard Facility
MI	Major Incidents
MR	Mixed Refrigerant
MRL	Mixed Refrigerant Liquid
NGSF	Newcastle Gas Storage Facility
pmpy	per million per year
QRA	Quantitative Risk Analysis
SFAIRP	So Far As Is Reasonably Practicable
VCE	Vapour Cloud Explosion
WHS	Work Health and Safety

REPORT

1 INTRODUCTION

1.1 BACKGROUND

AGL Energy Limited (AGL) proposes to develop a dual fuel power station in Tomago, New South Wales (NSW) (*the Newcastle Power Station*, or *NPS*). AGL is seeking approval for the Project from the NSW Minister for Planning and Environment under the NSW Environmental Planning and Assessment Act 1979.

The NSW Department of Planning, Industry and Environment (NSW DPIE) have developed an integrated assessment process for safety assurance of potentially offensive or hazardous development projects. This comprises a Preliminary Hazard Analysis (PHA) in accordance with:

- HIPAP No. 4: Risk Criteria for Land Use Safety Planning (Ref 1)
- HIPAP No. 6: Hazard Analysis (Ref 2)
- Applying SEPP 33: Hazardous and Offensive Development Application Guidelines (Ref 3)
- HIPAP No. 10: Land Use Safety Planning (Ref 4)
- Multi-Level Risk Assessment Guidelines (Ref 5)

The Secretary's Environmental Assessment Requirements (SEARs) for Hazard and Risk for the NPS Project include a PHA, covering all aspects of the NPS Project, which may impose public risks, to be prepared consistent with Hazardous Industry Planning Advisory Paper (HIPAP) No. 6 – *Guidelines of Hazard Analysis* (Ref 2) and *Multi-level Risk Assessment* (Ref 5).

The PHA for the NPS Project was prepared during the development application process for the Project and submitted together with the Environmental Impact Statement (EIS) for the Project, referred to as *the original PHA* in the present report.

AGL have identified a need for a number of temporary laydown areas for use during the construction phase of the NPS to allow for the storage of equipment not needed in the day-to-day construction activity.

One of these laydown areas is proposed to use a location within their existing Newcastle Gas Storage Facility (NGSF), referred to as the *East Laydown area*.

As people occupying the East Laydown area would be exposed to risks associated with the NGSF without being directly associated with the operations of the NGSF, the level of risk exposure from the NGSF to the laydown area needs to be assessed as per the NSW DPIE requirements (Refs 2, 3, and 5), and the resulting risk compared with land use safety criteria for a development adjacent to a potentially hazardous facility, as per the NSW DPIE's HIPAP10 *Land use safety planning* (Ref 4).

Further, the East Laydown area may impose risks to the people and processes at the NGSF, and this risk also needs to be assessed as per the NSW DPIE requirements (Refs 3 and 5).

Planager has been requested by Aurecon on behalf of AGL to assess the risk associated with the East Laydown area proposal and to prepare the present report. The report is prepared as an Addendum to the original PHA.

1.2 OBJECTIVES

The objective of this report is to:

- Assess the risk from the NGSF onto people occupying the East Laydown area to ensure that it does not exceed the risk criteria as defined in the NSW DPIE's risk criteria for land use planning (Refs 1 and 4);
- Identify any risks associated with the proposed East Laydown area that may impose a risk to the surrounding area, including to the NGSF (Refs 2 and 5).

The hazard analysis process encompasses qualitative and quantitative methods to assess the adequacy of the controls and to determine if the East Laydown area can be developed with the associated hazards kept as low as reasonably practicable (ALARP) and ensuring appropriate land use safety planning.

This report is prepared in accordance with DPIE methodology in their HIPAP6 (Ref 2) and Multi-level risk assessment (Ref 5). The risks to workers at the East Laydown area from the NGSF are assessed in accordance with the risk criteria in HIPAP4 and HIPAP10 (Refs 1 and 4).

1.3 METHODOLOGY

In implementing its requirements for risk assessment, NSW DPIE advocates an approach where the level and extent of the analysis should reflect the nature, scale and location of each development. The multi-level risk assessment methodology (Ref 5) espouses a mix of qualitative and quantitative approaches to enable the analysis and assessment to be taken only as far as is needed to demonstrate that the operation being studied does not or will not pose a *significant*[1] risk to surrounding land uses (Ref 5).

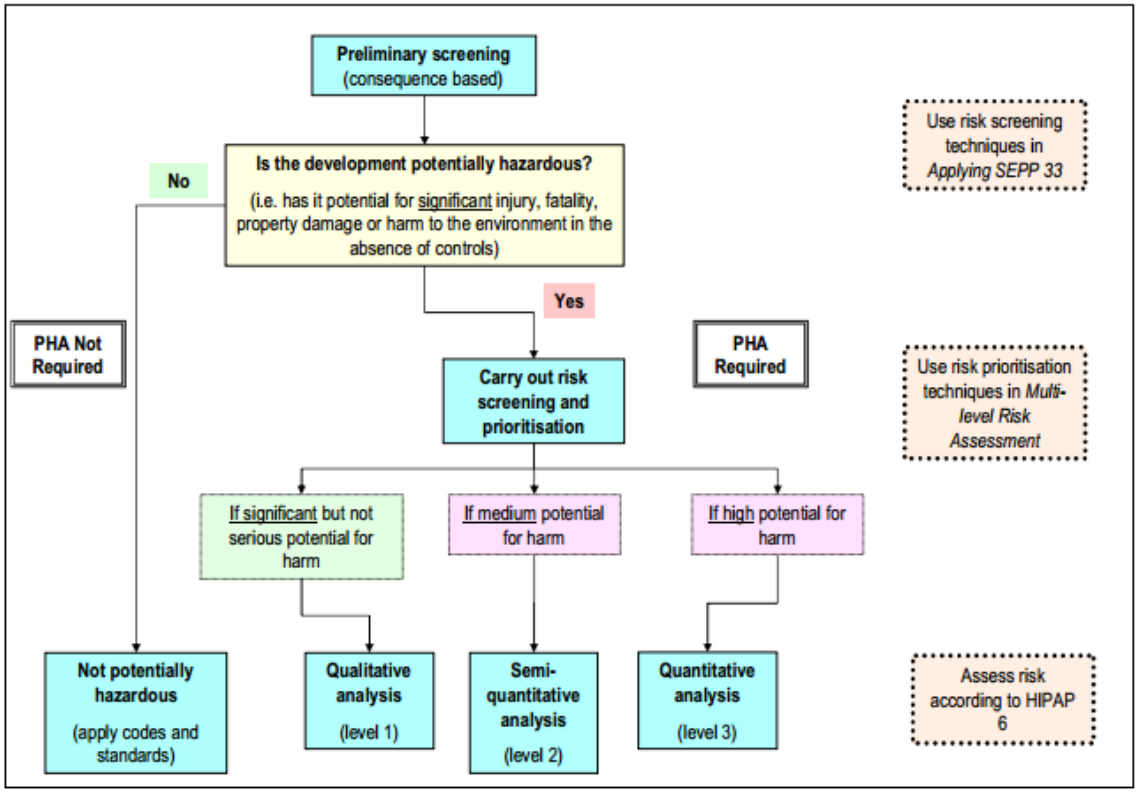
The three steps in the assessment are:

- Preliminary screening (Refer Section 2.6);
- Risk classification and prioritisation (Refer Section 4), and
- Risk analysis and assessment (Refer Section 5).
- Conclusion and recommendations (Refer Section 6).

These are shown diagrammatically in Figure 1 and described in more detail below.

1 While NSW DPIE do not define their term *significant* the present assessment understands this to refer to fatality or injury to people in the vicinity of the site, or impact to the biophysical environment causing long term damage or significant medium term impact on important environment/habitat and/or widespread local community complaints.

Figure 1: The multi-level risk assessment approach (Figure 3, Ref 5)



Step 1: Preliminary screening

The multi-level risk assessment bases its preliminary screening on the method described in State Environmental Planning Policy No. 33 – *Hazardous and Offensive Development* (SEPP 33, Ref 3). The method, which is described in Section A1.1 of NSW DPIE's *Multi-level Risk Assessment Guideline* (Ref 5), is based on broad estimates of the possible off-site effects or consequences from hazardous materials present on-site, taking into account locational characteristics.

If the quantity of hazardous materials present on-site is less than the screening threshold, then no further analysis is necessary. The safety management regime in this case relies on observance of the requirements of engineering codes and standards.

If the quantities of hazardous materials present on-site exceed the screening threshold, further analysis is necessary to ensure that then risk can be considered negligible to the surrounding area.

The restriction applied for the present East Laydown area is to ensure that the quantities of hazardous materials present on-site are kept well below the screening threshold in which case the East Laydown area is not considered to be Potentially Hazardous. With these restrictions in place, the results of the preliminary screening undertaken for the East Laydown area and the NGSF are given in Section 3.1.2 and Section 3.2.2 respectively.

Step 2: Risk classification and prioritisation

For facilities where the quantities of hazardous materials present on-site exceed the screening threshold in the multi-level risk assessment (Ref 5), risk ranking of the facility is determined using a risk classification and prioritisation technique as per Section A1.2 of the multi-level guidelines (Ref 5) which consists of a modified version of the method developed by the International Atomic Energy Agency (IAEA).

Step 3: Risk analysis and assessment

If the quantities of hazardous material on a site are below the screening thresholds in the multi-level risk assessment (Ref 5) there is no need to conduct detailed quantitative risk assessment (QRA) and a qualitative assessment of hazards and risks suffice. If the quantities exceed the thresholds, then a detailed QRA is required.

In detailed QRAs, negligible risk is expressed in terms of *individual* and *societal* risk, as follows:

- *Individual risk,* in the context of an industrial facility, is the risk that a hypothetical individual continuously present at a given location in the vicinity of the facility would be seriously injured as a result of incidents

occurring on that facility. It does not take into account whether an individual would actually be present or not at that particular given location. Individual risk shows the geographical extent and scale of risk presented by a facility, regardless of how many people are exposed to that risk, and can be used relatively easily as a basis for comparing different types of risks.

Individual risk at a given location is generally defined as the peak individual risk (or the risk of to the hypothetical individual located at the position for 24-hours of the day and 365 days in the year). Since residential areas tend to be occupied by at least one individual all the time, the above definition would easily apply to residential areas. A person indoors would receive natural protection from fire radiation and hence the risk to a person indoors is likely to be lower than to one in open air[2].

For land uses other than residential areas where occupancy is not 100% of the time, individual risk is still calculated on the same basis. However, the criteria for acceptability are adjusted for occupancy. The land use criteria used by the NSW DPIE for development adjacent to potentially hazardous facilities, as listed in their HIPAP4 and HIPAP10 (Refs 1 and 4)are listed in Table 1 below.

Table 1: Individual risk criteria (NSW DPIE HIPAP4 and HIPAP10)

Land Use	Individual Risk Criteria (per million per year)
Sensitive development (hospitals, schools, child-care facilities, old age housing)	0.5
Residential (and hotels, motels, tourist resorts)	1
Business (commercial developments including retail centres, offices and entertainment areas)	5
Active open space (including sporting complexes)	10

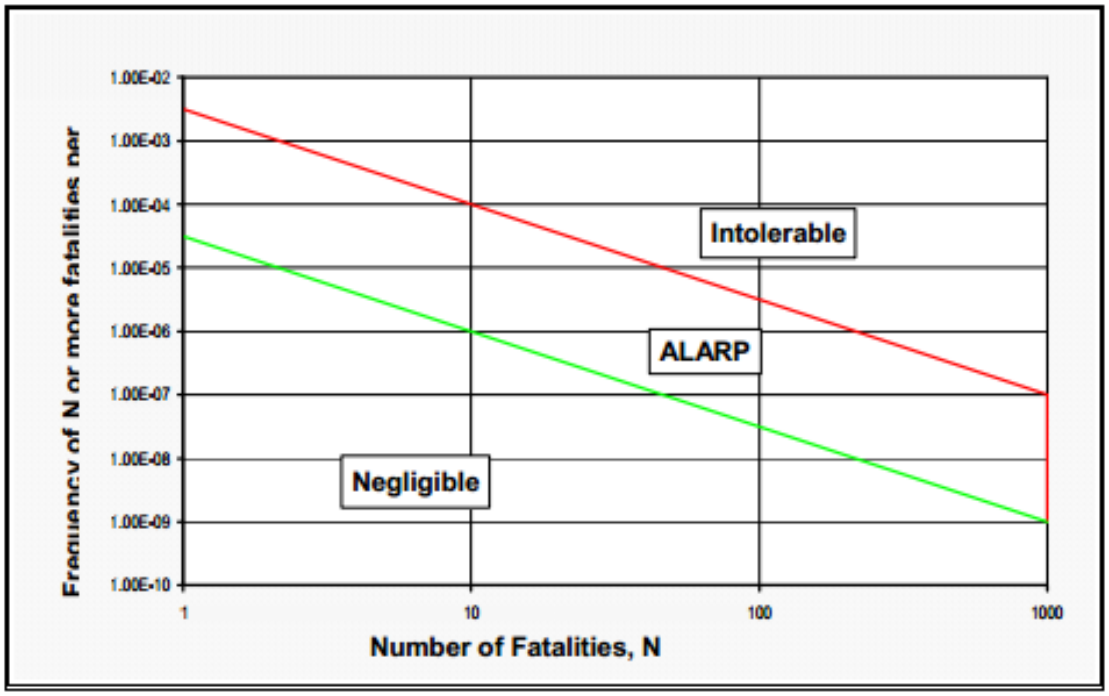
[2] In this study, the individual risk levels have been calculated for a person in open air.

Land Use	Individual Risk Criteria (per million per year)
Boundary of an industrial site (facility generating risk) (max risk at boundary of the site which generates the risk)	50
Injury risk criteria (4.7 kW/m^2 and for 7 kPa)	50
Propagation risk criteria (23 kW/m^2 and for 14 kPa)	50

- *Societal risk* estimates of overall risk to the population. Societal risk takes into account whether an incident occurs in time and space with a population being present by taking into account the size of the population that would be affected by each incident. By integrating the risk by the local population density over spatial coordinates, the global risk for a given accident scenario is obtained. By adding up the several risk functions (one for each scenario), a global risk function is obtained. In order to estimate the number of people affected, the population density outside of the industrial site under review is determined. Therefore, two components are relevant, namely:
    - the number of people exposed to an incident, and
    - the frequency of exposing a particular number of people.

  As shown in Figure 2, a societal risk F-N plot can be divided into three indicative societal risk bands (or zones): *negligible*, *ALARP*, and *innegligible*.

Figure 2: Indicative societal risk criteria (NSW DPIE HIPAP 4 and HIPAP10)



Within the negligible band, provided other individual criteria are met, societal risk is not considered significant. Above the negligible band, an activity may considered undesirable, even if individual risk criteria are met, unless adherence to ALARP principles can be demonstrated. Within the ALARP band, the emphasis is on reducing risks as far as possible towards the negligible band.

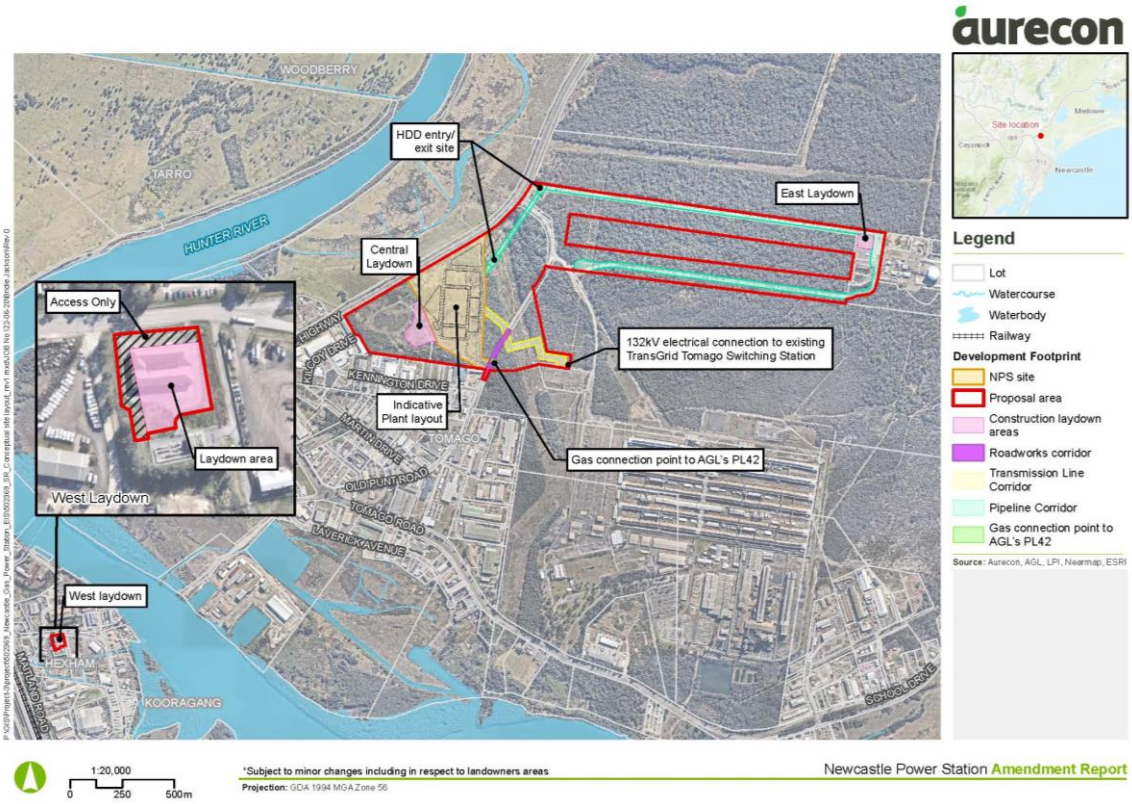
2 DESCRIPTION OF THE EAST LAYDOWN AREA

2.1 LOCATION

2.1.1 Location of the NGSF site

The NGSF site is located approximately 13 km northwest of the Newcastle central business district (CBD), 8 km south of Raymond Terrace and 4 km northeast of the Hexham industrial area (Figure 3). The East Laydown area will be located on NGSF site, as indicated in Figure 3 below.

Figure 3: Site location

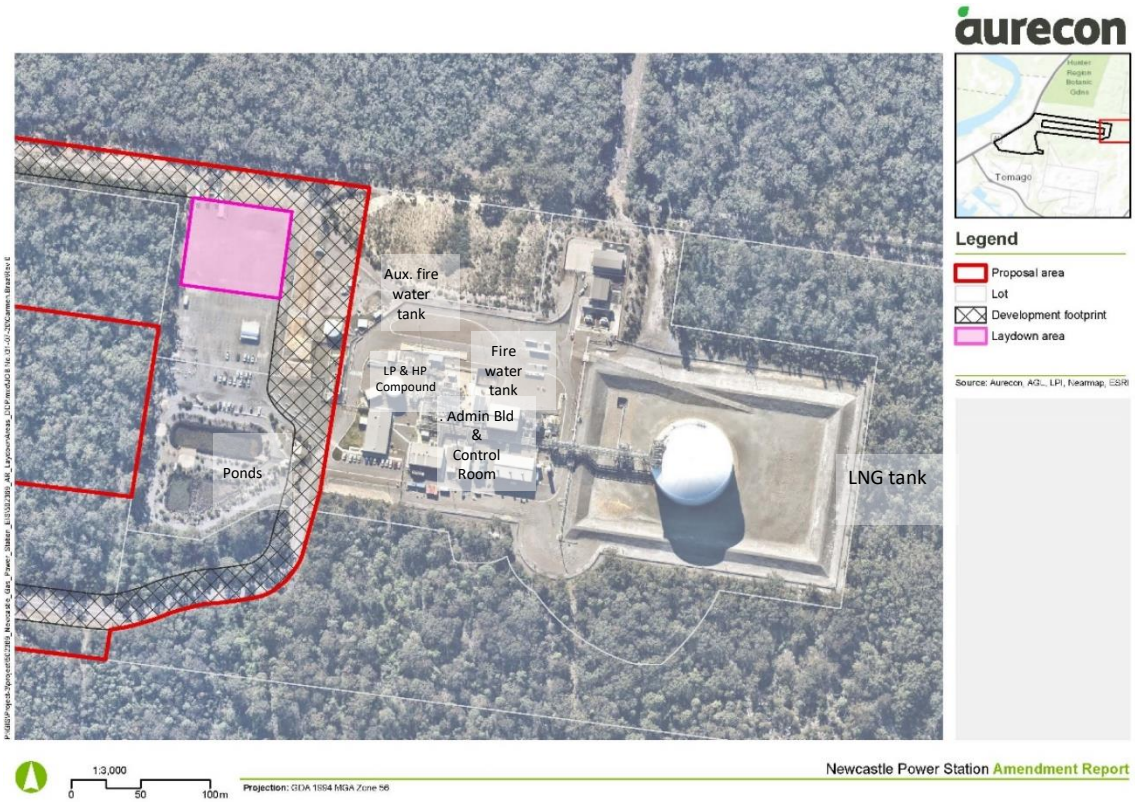


The site is located in industrial area zoned 4a (Industrial-General) within Port Stephens LGA and with a wide buffer to residential or sensitive neighbours such as public gathering places.

2.1.2 Location of the East Laydown area

The East Laydown area will be located on the hardstand area north of the NGSF contractors' carpark and north west of the processing facility at the NGSF, refer Figure 4 below.

Figure 4: Location of the East Laydown area on the NGSF site



2.2 EAST LAYDOWN AREA DURATION OF USE AND OCCUPANCY

2.2.1 Duration of use

The East Laydown area will be in use during the total period of the construction of the NPS, assumed to be for a maximum of 24 months.

2.2.2 Hours of operation

Hours of operation are likely to require alignment with NGSF approval hours for construction activities (e.g. 7am to 6pm Monday to Friday, 8am to 1pm Saturdays; cannot operate Sundays). The present risk assessment has conservatively assumed that people will be present at the East Laydown area 24/7, refer Section 2.2.3 below.

2.2.3 Occupancy

The following occupancy is assumed in the present assessment. This is likely to be conservative:

- at least one person at the laydown area 24 hours per day, 7 days per year. The societal risk calculations in the present report assume that one person is present during all night shifts and during daytime on Sundays.
- the number of people may increase to up to 10 people at times during the hours of operation. The societal risk calculations in the present report conservatively assumes 10 people present at the East Laydown area at all times during day shifts, 6 days per week.
- 20 light vehicles and 10 heavy vehicles are assumed to access the laydown area in any 24-hour period – this assumption does not have a bearing on the risk assessment as the quantities of DGs is well below the thresholds in SEPP33 and the multi-level risk assessment (Refs 3 and 5).

2.3 Overall site infrastructure - East Laydown area and adjacent NGSF

The East Laydown area will consist of an open air laydown, possibly covered with temporary roofing to protect stored equipment, with no underground storage. There may be a need for a temporary hut or small building. The present risk

assessment does not put any restriction on occupying the building day or night, with the total occupancy as per Section 2.2.3.

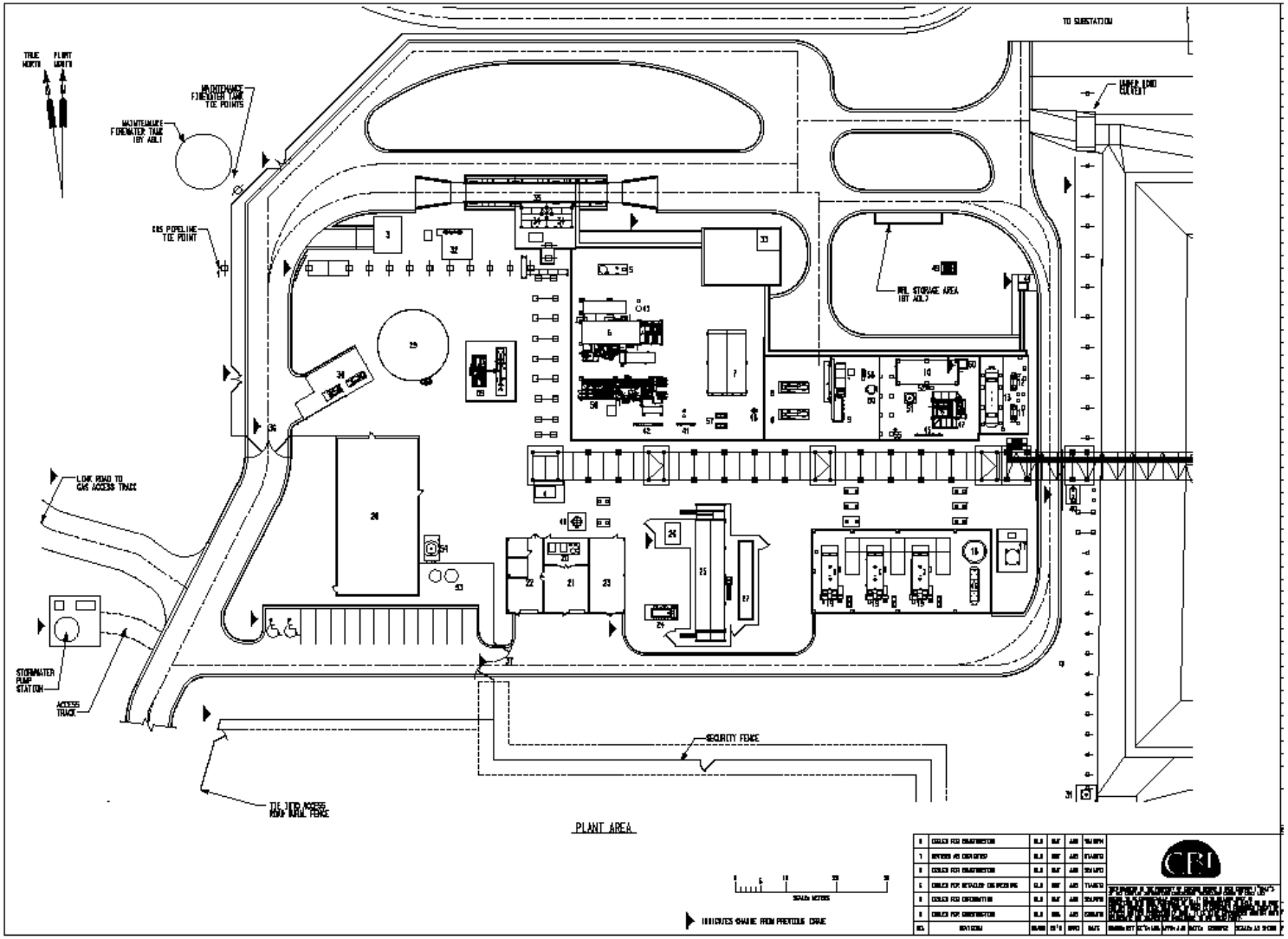
Table 2 details site infrastructure of the NGSF plant and associated facilities which is adjacent to the East Laydown area. Figure 5 shows the general layout of the overall NGSF facility, from the Final Hazard Analysis (FHA) for the NGSF (Ref 6).

Table 2: Site infrastructure and approximate distance from the East Laydown area to the NGSF

Site infrastructure	Approximate distance from the East Laydown area (metres)
Contractors carpark	Immediately to the south of the East Laydown area
High pressure pipeline (a bi-directional pipeline interconnecting the receiving stations at Hexham with the NGSF) and low pressure pipeline running below ground	Immediately adjacent to the north and east of the East Laydown area
High pressure and low pressure stations	120 metres southeast of the East Laydown area
NGSF pre-treatment plant where natural gas supplied via the high pressure pipeline station is treated to remove mercury, carbon dioxide (CO_2) and water vapour, and other components that could form a solid or potentially damage the facility	200 metres southeast of the East Laydown area
NGSF gas liquefaction facility where conversion of natural gas to liquid occurs in the main exchanger of the gas liquefaction unit (*cold box*)	250 metres southeast of the East Laydown area
Mixed Refrigerant Liquid (MRL) system used as refrigerant in the NGSF plant *cold box*. The MRL stream is composed of nitrogen, ethylene, iso-propane, and pentane. Each of these components is delivered to the site in cylinders carried on flat top trucks and loaded into the system. There are a number of pressure vessels for the MRL, including one vessel which can contain the full inventory of the system	250 metres southeast of the East Laydown area

Site infrastructure	Approximate distance from the East Laydown area (metres)
LNG Gas storage in a 63,000m^3 double wall cryogenic tank consisting of an open top cylindrical 9% nickel steel inner tank inside a carbon steel outer tank. The inner tank, containing the LNG consists of a shell and bottom, with a suspended deck 'roof' which has permanently open vents into the outer tank. Gas produced through evaporation is contained by the outer tank. The low temperature of the LNG (approx. -162°C) is maintained by the insulation surrounding the inner tank and by continuous vaporisation and boil-off of gas which is extracted from the top of the tank and compressed to supply the Jemena low pressure network via the low pressure station	350 metres west/south west of the East Laydown area
Retention ponds	140 metres south of the East Laydown area

Figure 5: NGSF process area layout (extract from the FHA)



2.4 SECURITY

The NGSF site is entered via the security gate off Old Punt Road, with the access gate currently opened by site personnel (usually by the Operations Team from the control room) using the intercom or by personnel using site access cards.

The East Laydown area will be accessed using the same security gate.

As an MHF, the NGSF is obliged to operate under a Security Plan.

The NGSF processing area is protected via a processing area security fence, but the car park area is fully opened to the forest tracks. It is currently possible for people to enter the carpark area from a number of tracks through the nearby forested area.

Recommendation 1: The NPS Project will need to determine the means with which people accessing the East Laydown area will enter and exit the site at the security gate at Old Punt Road.

Recommendation 2: As the NGSF carpark area can be accessed from the forest tracks, security of the East Laydown area will need to be determined.

Recommendation 3: To ensure that the proposed East Laydown area does not compromise security at the NGSF the NPS Project will need to develop a Security Plan for the East Laydown area and this Plan is to be integrated with the NGSF Security Plan.

Recommendation 4: Regular inspection to be carried out of the East Laydown area.

2.5 STORAGES AND TRANSPORT

Storages of potentially hazardous/pollutant material and/or Dangerous Goods (DGs) at the East Laydown area are likely to include material commonly used in construction activities such as:

- bags of cement and other materials used during surface preparation, e.g. garnet (for grid blasting);
- gas cylinders (DG Class 2.2 and DG Class), e.g. nitrogen, oxygen, acetylene;
- small quantities of paints and resins (DG Class 3 PGII and PGIII and/or C1 and C2);
- surface coatings (environmentally hazardous solvent, DG9).

All materials are to be stored as per manufacturer's recommendation, SDS requirements and any relevant Australian Standard and/or Codes of Practice (including signage, depot numbers).

Quantities of DGs and other potentially hazardous/pollutant material will be held well below the NSW DPIE SEPP33 screening thresholds (Ref 3), refer to Table 3 in the present report for ease of reference. Further, transportation of DGs will be well below the SEPP33 *Transportation Screening Thresholds* (Ref 3, Table 2).

In addition, no potential liquid pollutants are to be stored at the East Laydown areas (i.e. no fuel, lubricants, oils, corrosive liquids etc.) and no packages containing environmental pollutant material. This is to ensure that the Tomago sand beds are protected.

By ensuring the above restrictions are applied, the risk of a major incident involving DGs or potentially hazardous material at the East Laydown area is kept to a minimum with no credible scenarios identified for propagation to the adjacent NGSF processing facility and no impact on the Tomago sand beds.

In addition, the following recommendations are made:

Recommendation 5: A Spill/Loss of Containment (LOC) Control Management Plan to be developed for all potentially hazardous/pollutant chemicals to be stored on-site, with spill kits available. In case of a spill, personnel at the East Laydown area to be trained in spill response and, if needed, in initiating the emergency response procedure.

Recommendation 6: Emergency response plan (ERP) in accordance with AS3745 applicable for the East Laydown area to be developed and to be integrated with the NGSF ERP.

Recommendation 7: Tactical Fire Plan or other information to be developed and included in the ESIP for the East Laydown area as per NSWFR requirements for the site.

2.6 Safety Management System

Work at the East Laydown area will be managed as per the requirements for safety management in Australia (including the WHS Act and Regulation). The NGSF site is managed under a Safety Management System (SMS) which formed part of the Conditions of Consent for the site.

The SMS for the NGSF site, which includes the East Laydown area, will form part of the overall control of the laydown area.

This is expected to involve a level of control or overview of the NPS Project implementation of the requirements of the NGSF SMS for the East Laydown area.

3 PRELIMINARY SCREENING

The purpose of the preliminary screening method in the Multi-level risk assessment guideline (Ref 5) is to exclude from more detailed study those developments which do not pose *significant* risk and the development would not be classified as *potentially hazardous* (subject to checking other factors).

The screening method in the Multi-level risk assessment guideline (Ref 5) is relatively high level, the underlying assumptions used, as stipulated by NSW DPIE, are conservative, and consider the consequences of hazards in the absence of any safeguards (Ref 5).

The preliminary screening for the East Laydown and the NGSF are detailed in Sections 3.1 and 3.2 respectively.

3.1 EAST LAYDOWN AREA

3.1.1 Hazardous material

The hazardous material likely to be stored at, and restricted from, the East Laydown area are detailed in Section 2.5 and Section 3.1.2.

3.1.2 Screening assessment

The screening assessment for the East Laydown area is detailed in Table 3.

Table 3: Screening assessment, East Laydown area

Dangerous Goods Class	Max quantities allowed on-site as per NGSF restrictions	SEPP 33 Screening threshold	Result
1.1	None allowed	100kg	Zero presence of DGC 1 on-site. No further evaluation required

Dangerous Goods Class	Max quantities allowed on-site as per NGSF restrictions	SEPP 33 Screening threshold	Result
2.1 pressurised flammable gas (excl LPG)	Small number of cylinders, net weight below 100kg	100kg	The quantities allowed to be held on-site are well below the screening thresholds. Laydown area is not *potentially hazardous* (SEPP33) or associated with *significant risk*
2.1 Flammable gases liquefied under pressure (excl. LPG)	Small number of cylinders, well below 500kg	500kg	The quantities allowed to be held on site are well below the screening thresholds. Laydown area is not *potentially hazardous* (SEPP33) or associated with *significant risk*
2.1 LPG (above ground)	Small number of cylinders, well below 500kg	10 te or $16m^3$	The quantities allowed to be held on-site are well below the screening thresholds. Laydown area is not *potentially hazardous* (SEPP33) or associated with *significant risk*
2.2 non flammable gases	No restriction	No restriction	May cause a hazards on East Laydown area but no expected effect outside laydown area boundary. Laydown area is not *potentially hazardous* (SEPP33) or associated with *significant risk*
2.3 Toxic gases	None allowed	Various, dependent on type of material	Zero presence of DGC 2.3 on-site. No further evaluation required. Laydown area is not *potentially hazardous* (SEPP33) or associated with *significant risk*
3 PGI Flammable liquids	None allowed	2 te	Zero presence of DGC 3 PGI on-site. No further evaluation required. Laydown area is not *potentially hazardous* (SEPP33) or associated with *significant risk*
3 PGII or PGIII Flammable liquids or C1/C2 located adjacent to	No DGC3 PGII/III allowed except for for paints, resin etc. which may be DGC3 PGII/III or C1/C2 held at well below 5 tonnes	5 te	The quantities allowed to be held on-site are well below the screening thresholds. Laydown area is not *potentially hazardous* (SEPP33) or associated with *significant risk*

Dangerous Goods Class	Max quantities allowed on-site as per NGSF restrictions	SEPP 33 Screening threshold	Result
4 Flammable solids 5 Oxidising material 6 Toxic and Infectious 7 Radioactive	None allowed Exception may be pressurised oxygen if stored to Code requirements and risk assessment conducted	Various, dependent on type of material	Zero presence of DGC 4, DGC 5, DGC 6 or DGC 7 on-site with the possible exception for oxygen used for welding, in which case a risk assessment would need to be conducted. Max quantities would need to be maintained well below SEPP33 thresholds (Ref 3). Laydown area is not *potentially hazardous* (SEPP33) or associated with *significant risk*
8 Corrosive liquids	None allowed	5 te (PG I) 25 te (PG II) 50 te (PG III)	Zero presence of DGC 8 on-site. No further evaluation required. Laydown area is not *potentially hazardous* (SEPP33) or associated with *significant risk*
9 Miscellaneous	No restrictions	No restrictions	May cause hazards on East Laydown area but unlikely to have a significant effect outside laydown area boundary. Laydown area is not *potentially hazardous* (SEPP33) or associated with *significant risk*

With the restrictions to the storages and handling of DGs and potentially hazardous material, the risk of the East Laydown area is not associated with a *Potentially Hazardous* as per the definition in SEPP 33 (Ref 3) and there is not considered to be a *significant risk* as per the NSW DPIE's multi-level risk assessment guideline (Ref 5).

A qualitative assessment of hazards and risks is considered sufficient to assess the risk from the East Laydown area (Ref 5), as included in Section 5 of the present report.

3.2 NGSF

3.2.1 Hazardous materials

A range of hazardous materials are used, handled, and stored at the NGSF. The types of hazardous materials are present in Table 4 below. As there are substantial amounts of potentially hazardous materials stored and handled on the NGSF site, the risk and prioritisation technique presented in Ref 5 applies for the NGSF as it may impose risk to people within the East Laydown area.

The approximate location of DGs on the NGSF site are presented in Figure 6.

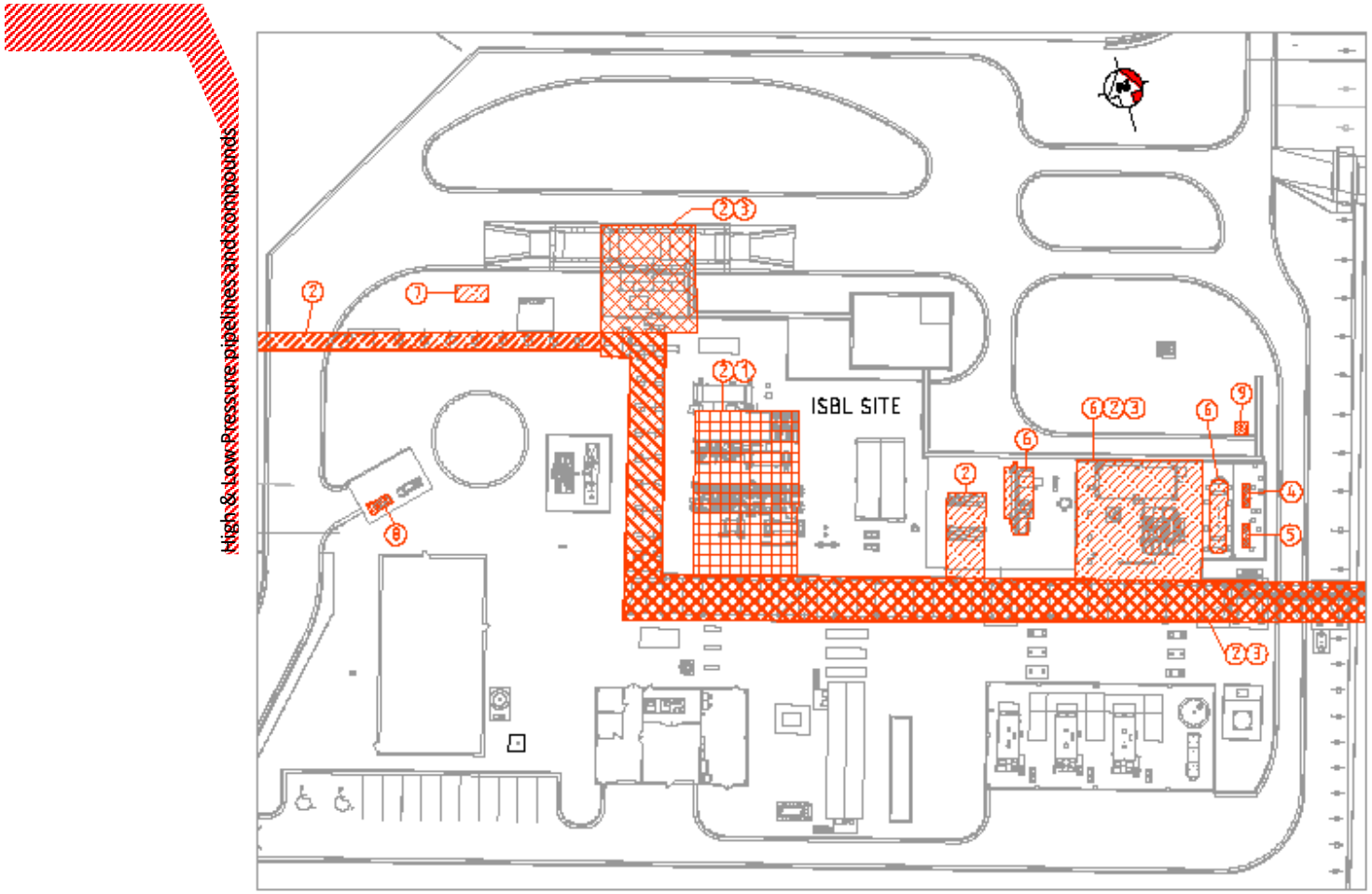
Table 4: Dangerous Goods stored and handled at the NGSF

Chemical/ Product	VESSEL	DG Class	HAZCHEM Code	UN CODE	Maximum storage quantity
Natural gas	N/A	2.1	2SE	1971 (as methane)	Nil in storage. 30 tonnes in process (includes all vessels and pipelines, incl. the high pressure pipeline used to transport natural gas to and from the NGSF)
LNG	T4	2.1	2WE	1972	30,000 tonnes (63,000 m^3).
Mixed refrigerant (MRL)	V-205 V-204 Bottles V-203	2.1 3 PGI 2.1 2.1	2YE 3YE 2SE mixture	1078 1265 1962 mixture	2.2 tonnes of propane 2.6 tonnes iso-pentane 0.5 tonnes ethylene 0.5 tonnes (operation mode) Max LNG inventory in process: 3.2 tonnes[3]
Odorant[4]	V-401	3 Pk II	3WE	3336 (as mercaptan	2 vessels @ 850 kg each
Amine (CS1160)	Part of pre-treatment	8 PG III	2X	3267	12,000 L inventory within pre-treatment vessels and piping.
Diesel	Emergency generator and fire pump skids	3 (or C2 depending on supplier)	3Y (if DG Class 3; N/A if C2)	1202	Typically 200-500 L

[3] Total of propane, butane, ethylene, methane, butane, i-pentane and nitrogen.

[4] Mixture 70:30 between tetra hydro thiophene and tertiary butyl mercaptan

Figure 6: Dangerous Goods on the NGSF inside battery limit plot plan (LNG storage tank, to the East, now shown)



3.2.2 NGSF screening assessment

As described in the multi-level risk assessment guideline (Ref 5), the SEPP 33 screening method divides dangerous goods into three main categories: explosives; flammable gases and liquids, and others such as toxics and corrosives. Non-flammable, non-toxic gases, combustible liquids and miscellaneous hazardous substances are not included in the screening methodology (Ref 5).

In the case of flammable liquids and gases, the screening method assumes the entire inventory is involved in an accident, generating heat radiation which will vary with distance. If, at the site boundary, the heat radiation level is below 12.6kW/m^2 for 30 seconds, then it is assumed that there is minimal likelihood of death or serious injury. Above this level, the risk may be significant and further analysis is warranted. Since the threshold is dependent on both quantity and distance, a graphical approach, combining both factors, is used in the screening method for these materials.

For other classes of DGs, such as corrosive or toxic materials, a clear-cut relationship between distance and the level of harm has not been included in the NSW DPIE guidelines and for this reason, thresholds are based on quantity only. The values chosen are such that there is little likelihood of harm outside the site boundary below the threshold, even when the material is kept relatively close to the site boundary so long as the normal separation distances required by relevant Codes and Standards apply.

The results of the screening assessment obtained using the quantities of hazardous materials listed in the multi-level risk assessment guidelines (Ref 5) are given in Table 5. Where the quantities listed in Table 5 are by volume rather than weight, a specific gravity of 1 has been used in the conversion.

The results indicate that the storage quantities of flammable gases exceed the SEPP 33 threshold. In addition, the LPGs (or MRL) inventory is close to the threshold limits. Further analysis of these materials is therefore required for

flammable gases and liquids. The results are in line with those obtained in the earlier studies (e.g. in the FHA for the NGSF, Ref 6).

Table 5: Screening assessment, NGSF

Dangerous Goods Class	Max quantities on NGSF	SEPP 33 Screening threshold	Result
2.1 pressurised flammable gas (excl LPG)	*Natural gas*: Nil in storage. 30 tonnes in process (includes all vessels and pipelines, incl. the HP pipeline) *LNG*: 30,000 tonnes (63,000 m3)	100 kg or distance to site boundary applies	Well above the SEPP 33 threshold, potentially significantly hazardous. The material is carried forward to the detailed QRA
2.1 Flammable gases liquefied under pressure excl. LPG or LPG (above ground)	2.2 tonnes propane 2.6 tonnes iso-pentane 0.5 tonnes ethylene Max in process: 3.2 tonnes[5] TOTAL: 8.5 tonnes	If counted as flammable gases liquefied under pressure: 500kg If counted as LPG: 10 te	Less than (though close to) the threshold of 10 te if classified as LPG but well above the threshold if classified as flammable gases liquefied under pressure. The material is carried forward to the detailed QRA
3 PGII 3 PGII or C2 depending on supplier	Odorant: 2 vessels @ 850 kg each TOTAL: 1.7 tonnes Emergency generator & fire pump skids: Typically 200-500 L	DG3PGII: 2 te but dependent on distance to boundary DG2: not incl. in screening method	Less than the screening threshold as distance to boundary complies Material is not carried forward to the detailed QRA and standard adherence to Australian Standards applies
8 PGIII	Amine: 12m^3 within vessels and piping	50 te	Less than SEPP 33 threshold Material is not carried forward to the detailed QRA and standard adherence to Australian Standards applies

[5] Total of propane, butane, ethylene, methane, butane, i-pentane and nitrogen.

4 RISK CLASSIFICATION AND PRIORITISATION

4.1 EAST LAYDOWN AREA

The storages of DGs and other potentially hazardous material at the East Laydown area are maintained below the NSW DPIE threshold for potentially hazardous facilities.

Explosion: There will be no explosive material stored at the East Laydown area.

Fire events: Such events are limited to ignition of flammable gases contained in the cylinders or paints and resin stored in quantities which are to be maintained well below the general screening thresholds in the NSW DPIE SEPP33 guidelines (Ref 3). The consequences of a fire event on the East Laydown area is not likely to affect areas outside of the Laydown area boundary including the NGSF. No other storages of flammable or combustible liquids are allowed. Since none of the scenarios have effects that extend beyond the Laydown area boundaries, the off-site population within the effect areas is zero and the results will sit within the negligible zone of the indicative societal risk F-N plot shown in Figure 2, independently of the likelihood of these major incident events. It is therefore not necessary to undertake the IAEA analysis in the guideline (Ref 5) Section A1.2.5 *Estimation of probabilities of major accidents* to establish that a qualitative risk analysis and assessment is sufficient for fire events. Further, no scenarios have been identified that may seriously affect the NGSF processing facility and cause propagation events.

Release of Flammable solids, self-reactive substances and solid desensitised explosives or Substances liable to spontaneous combustion: There will be no DGC 4.1 or DGC 4.2 stored or handled at the East Laydown area, and as such, there is no risk of exposure or environmental pollution from DGC 4.1 or 4.2 material.

Release of oxidising substances or organic peroxides: Only minor quantities of oxidising material (DGC 5.1) may be stored at the East Laydown area, such as

oxygen in cylinders stored at belowe SEPP33 threshold quantities. Standard Codes and Standards apply for the storage of cylinders, including ensuring that oxidising cylinders are located away from flammable gases such as acetylene, LPG etc. No other DGC 5 storages are to be allowed, including no storages of organic peroxides allowed on the East Laydown area. There is very low risk of exposure from oxidising substances.

Release of toxic substances: No toxic material is to be stored at the East Laydown area and, as such, there is no risk of exposure from toxic material.

Release of corrosive substances: There will be no storage of corrosive liquids (DGC 8) on the East Laydown area and, as such, there is no risk of exposure or environmental pollution from corrosive material.

Release of environmentally hazardous substances: While the risk and prioritisation technique presented in the multi-level risk assessment in Ref 5 does not refer to environmentally hazardous substances (DGC 9), these substances have been considered in the qualitative risk analysis and assessment in Section 5.

4.2 NGSF

Fire events: The risks at the site are characterised by the potential fire risks associated with flammable gases and liquids DGC 2.1, including pressurised natural gas, LNG and Mixed Refrigerant Liquids.

There is no need to prepare a risk prioritisation assessment for the NGSF as the outcome is already known, and the site needs to be assessed using the highest level of detail in a full QRA.

The potential hazards associated with DGS and other potentially hazardous material at the NGSF processing area has been included in the qualitative and quantitative risk analysis and assessment in Section 5.

5 HAZARD AND RISK ASSESSMENT

5.1 HAZARD IDENTIFICATION

The risk analysis is based on a comprehensive identification of all potential hazards associated with the dangerous and hazardous goods stored at the East Laydown area and at the NGSF as well as a review other hazards that could introduce a threat, e.g. security hazards, bush fire etc.

The hazard identification includes a comprehensive identification of possible causes of potential incidents and their consequences to human safety and the environment, as well as an outline of the proposed operational and organisational safety controls required to mitigate the likelihood of the hazardous events from occurring.

The results are presented as a Hazard Identification Word Diagram in Table 6, developed as per the NSW DPIE requirements in their HIPAP6 guidelines (Ref 2).

Table 6: Hazard Identification Word Diagram

Facility	Event	Possible Causes	Possible Consequences	Preventative and Protective Safeguards	Carried forward to QRA
East Laydown area	1. Spillage of leakage of flammable or combustible liquid. Spillage or leak of corrosive liquid. Spillage or leak of toxic substance.	Impact, mechanical failure, corrosion; damage to container from impact by moving vehicle; dropping, pinching etc.	Leak to atmosphere, loss of containment of flammable or combustible material. Environmental pollution if not contained. Fire if ignition of flammable material. Injury or fatality risk to people at the East Laydown area. Potential for propagation and damage to neighbouring areas, e.g. to the NGSF.	**Prevention:** No storage of flammable, combustible, corrosive or toxic material allowed on the East Laydown area. (Paints and resins are exempted, refer to scenario 3 below)	This risk is eliminated. No need for further analysis.

Facility	Event	Possible Causes	Possible Consequences	Preventative and Protective Safeguards	Carried forward to QRA
East Laydown area	2. Damage to package containing environmental pollutant material e.g. cement bags or other bag containing solids used in construction e.g. garnet (for grid blasting).	Mishandling of package containing solid. Wrong method used to move bags or containers. Failure of equipment (forklift) used to move bags or containers. Operator error.	Loss of containment of environmentally hazardous material. Environmental damage possible. Injury to personnel if exposure.	**Prevention:** Materials stored as per manufacturer's recommendation / Codes / Standards. Bags of cement strapped on pallets. Traffic management. High Risk Licence for FLT drivers. **Detection:** Storage to facilitate detection of leaks. Regular inspections. **Protection:** Register and SDSs for DGs and other potentially hazardous materials. Separation distance exceeds 100m between East Laydown area and NGSF minimising propagation risk from laydown area to NGSF. Secondary containment in ponds ensure pollutant material does not leave the site. PPE used by personnel. **Emergency response**: Spill / LOC Control Management Plan and spill kits available. Emergency response plan (ERP) applicable for the East Laydown area to be integrated with the NGSF ERP.	Provided that the legal requirements, recommendations commitments in Sections 6.1 and 6.2 are implemented the risk is managed. There is no need for further analysis.

Facility	Event	Possible Causes	Possible Consequences	Preventative and Protective Safeguards	Carried forward to QRA
East Laydown area	3. Failure or leak from paint tins, small containers of resin or surface coating. Leak from gas cylinders (e.g. acetylene, oxygen, nitrogen, nitrous oxide etc.).	Impact, mechanical failure, corrosion; damage to container from impact by moving vehicle; dropping, pinching, operator error.	Leak to atmosphere, loss of containment of gas or viscous liquid (resin / paint). Flammable material can ignite and cause serious injury or damage. Heat may cause safety device on gas cylinders to activate and release the gas contents of the cylinder. Oxygen or other oxidising or gas release causes oxygen enrichment with materials igniting easily and will increase the intensity of a fire. Flammable gas will intensify fire. The gas pressure is high and a ruptured cylinder or valve can cause serious injury or damage.	**Prevention:** Materials stored as per manufacturer's recommendation / Codes / Standards. Traffic management. High Risk Licence for FLT drivers. No transfer operations for DGs / hazardous material. **Detection:** Regular inspections. **Ignition prevention:** NGSF site is a no smoking / dematched site. Hot Work would be managed under Permit To Work system (under overall WHS control by NGSF). All electrics to relevant AS3000 requirement. **Protection:** PPE (e.g. safety shoes, safety glasses). Separation distance exceeds 100m to NGSF minimising risk of propagation. Cylinders managed to below SEPP33 threshold quantities. Storage and segregation of incompatible cylinders as per SDS and legal requirements. **Emergency response**: Spill / LOC Control Management Plan and spill kits to be available. Emergency response plan (ERP) applicable for the East Laydown area to be integrated with the NGSF ERP.	Provided that the legal requirements, recommendations commitments in Sections 6.1 and 6.2 are implemented the risk is managed. There is no need for further analysis.

Facility	Event	Possible Causes	Possible Consequences	Preventative and Protective Safeguards	Carried forward to QRA
East Laydown area	4. Security breach / sabotage.	Unlawful entry to the site (via Old Punt Road; forest tracks)	Thefts at the East Laydown area. Sabotage at East Laydown area. Possible initiation of a major incident at the NGSF. Potential injury, fatality. Potential for environmental pollution,	**Prevention:** Security at site entry (Old Punt Road) and forest tracks. **Detection:** Regular inspections. **Protection:** Access control to NGSF processing area. **Security Management**: Security Plan.	Provided that the legal requirements, recommendations commitments in Sections 6.1 and 6.2 are implemented the risk is managed. There is no need for further analysis.
East Laydown area	5. Excessive weight at the underground high and/or low pressure natural gas pipelines, or vibrations, causes damage to the pipeline.	Failure to manage weight or vibration on top of underground pipelines (storage of heavy equipment at the Laydown area or major vehicle traverses).	Damage to pipelines, LOC of pressurised flammable natural gas, ignition and fire. Potential propagation to the NGSF and initiation of a major incident, Injury and fatality to people at the East Laydown area of the NGSF.	**Prevention: U**nderground pipelines to be protected (weight of stored equipment at the East Laydown area, heavy vehicles traversing etc.). **Detection:** Regular inspections. **Protection:** Underground pipelines segregated from East Laydown area. **Emergency Management**: NGSF Emergency response plan (ERP). Emergency alarm at the NGSF to sound also at the East Laydown area.	Provided that the legal requirements, recommendations commitments in Sections 6.1 and 6.2 are implemented the risk is managed. There is no need for further analysis.

Facility	Event	Possible Causes	Possible Consequences	Preventative and Protective Safeguards	Carried forward to QRA
East Laydown area	6. General health and safety risks to NGSF and East Laydown area personnel.	Vehicle impact. WHS risk (ergonomics etc.).	Injury or fatality. Property damage.	**Prevention**: Traffic management. High Risk Licence. Induction including AGL Code of Conduct. Coordination of contractor's WHS in AGL NGSF SMS.	Provided that the legal requirements, recommendations commitments in Sections 6.1 and 6.2 are implemented the risk is managed. There is no need for further analysis.

Facility	Event	Possible Causes	Possible Consequences	Preventative and Protective Safeguards	Carried forward to QRA
Surrounding area: Incident at the NGSF affects the East Laydown area	7. Flammable events at the adjacent NGSF affects workers on East Laydown area.	LOC of pressurised flammable gases or liquids at the NGSF ignite at the NGSF. LOC of pressurised flammable gases or liquids at the NGSF ignite at the East Laydown area.	Dispersing flammable vapour cloud, flash fire/VCE, BLEVE. Heat radiation and explosion overpressure. Injury or fatality of people at the East Laydown area (harm at the NGSF is discussed in the NGSF FHA, Ref 6).	**Prevention:** Prevention of flammable event at the NGSF provided in details in the various hazard and risk studies for this facility e.g. FHA in Ref 6. **Ignition prevention:** NGSF site is a no smoking / dematched site. Hot Work managed under Permit To Work system (under overall WHS control by NGSF). All electrics to relevant AS3000 legal requirement **Detection:** Emergency alarm at the NGSF to sounds also at the East Laydown area. **Protection:** Separation distance exceeds 100m between East Laydown area and NGSF, minimising propagation risk from NGSF to laydown area. **Emergency response**: Site Induction. Emergency response plan (ERP) applicable for the East Laydown area to be integrated with the NGSF ERP. Tactical Fire Plan or other information in the ESIP to be developed for the East Laydown area as per NSWFR requirements.	QRA is required to ensure the levels of risk exposure at the East Laydown area adhere to applicable NSW DPIE risk criteria in their HIPAPs 4 and 10 (Refs 1 and 4).

Facility	Event	Possible Causes	Possible Consequences	Preventative and Protective Safeguards	Carried forward to QRA
Surrounding area: Adjacent bushland	8. Bushfire.	Initiated by personnel at the East Laydown Area or by other source.	Threat of injury or fatality to people or facilities at the East Laydown Area. Damage to equipment stored at the Laydown Area. Potential for propagation to the NGSF processing facility and initiation of a majhor incident.	**Ignition prevention:** NGSF site is a no smoking / dematched site. Hot Work managed under Permit To Work system (under overall WHS control by NGSF). All electrics to relevant AS3000 legal requirement. **Protection:** Asset Protection Zone (APZ) to be determined for the East Laydown area. APZ already determined for the NGSF. **Emergency response:** ERP to be integrated with the NGSF ERP. Tactical Fire Plan or other information in the ESIP.	Provided that the legal requirements, recommendations commitments in Sections 6.1 and 6.2 are implemented the risk is managed. There is no need for further analysis.

5.2 KEY RISK CONTRIBUTORS

The NGSF site uses and processes hazardous materials which have the potential to cause major incidents resulting in risks to occupants of the East Laydown area due to fire or explosion caused by the ignition of flammable liquids or gases.

A number of major fire or explosion incidents were identified for the NGSF during the development stage of the NGSF, as reported in the Final Hazard Analysis (FHA, Ref 6).

The incidents that have a potential to affect the East Laydown area and cause serious harm to occupants at this area are listed Table 7.

Risks from the these incidents to the occupants at the East Laydown area has been carried forward to further quantitative risk analysis.

Other incidents, such as a LOC of LNG into the process or tank sump, are not expected to affect the East Laydown area – these are included in the table below in grey font.

Table 7: List of incidents at the NGSF that have a potential to affect the East Laydown area

MI No	Area	Title	Scenario
MI-01	LNG tank	LOC of LNG into tank bund	MI-01-01 Pool fire of LNG in tank bund
			MI-01-02 VCE / flash fire from LOC of LNG in tank bund
MI-02		LOC of LNG into tank sump	MI-02-01 Pool fire of LNG in tank sump
MI-03	Process area (vaporisation, liquefaction)	LOC of LNG in process area	MI-03-01 Pool fire of LNG in process area sump
MI-04		LOC of high pressure NG in process area	MI-04-01/02 Jet fire, flash fire or VCE from rupture/major leak in high pressure natural gas in process area
MI-05		LOC of medium pressure NG in process area	MI-05-01/02 Jet fire, flash fire or VCE from rupture/major leak in medium pressure natural gas in process area
MI-07	MRL storage	LOC of MRL at storage area and handling area	MI-07-01 Pool fire of MRL in process area sump
		BLEVE of MRL storage vessel or cylinder	MI-07-02(1/2) BLEVE of MRL storage vessel (mixing tank / propane vessel)
		LOC of MR gas at storage and handling area	MI-07-03(1/2) Jet fire, flash fire or VCE of MR gas from rupture/major leak in pipe or vessel
MI-08	MRL /cylinder unloading & cylinder storage	LOC of MRL during cylinder transfer and storage	MI-08-01 Pool fire of MRL in process area sump
			MI-08-02 BLEVE of MRL cylinder
MI-09	Site buildings	Ingress of flammable gas in confined space	MI-09-01 Explosion of flammable gas inside confined building
I-03	Low pressure pipeline and LPP station	LOC of natural gas at Low Pressure Pipeline	I-03 Jet fire due to rupture or leak of low pressure natural gas pipeline or in HP pipeline compound
I-04	HP pipeline and HP station	LOC of high pressure NG at HP pipeline	MI-10-01/02 Jet fire due to rupture or major leak in HP pipeline or in HP pipeline compound

Notes: LOC - Loss of containment Notes: VCE - Vapour Cloud Explosion; BLEVE - Boiling Liquid Expanding Vapour Explosion

5.3 CONSEQUENCES ANALYSIS

5.3.1 Consequence modelling

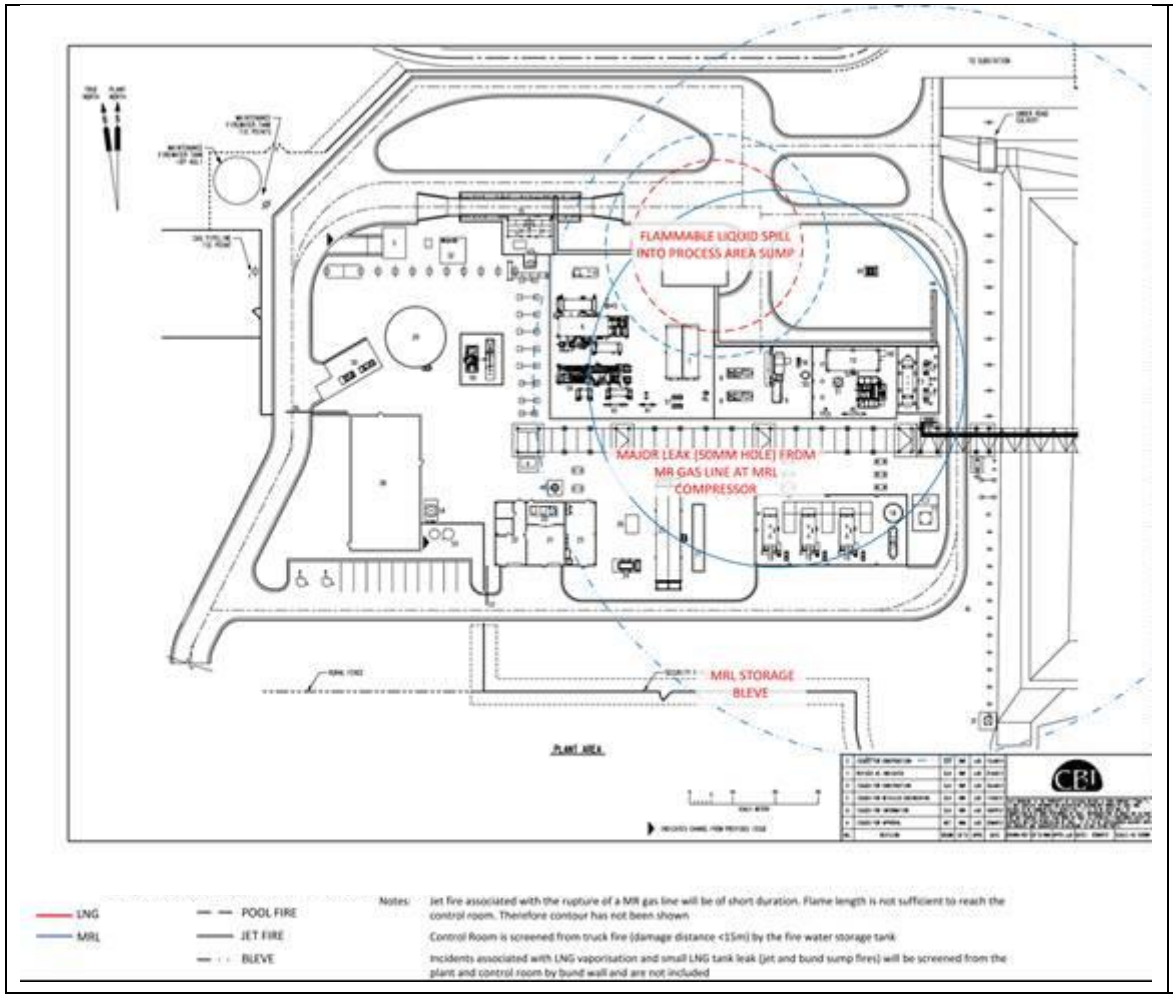
The extent of the heat radiation or explosion overpressure contour from a major incident at the nearby NGSF plant and processes, and its potential to affect the East Laydown area depends on a number of factors including:

- properties of the flammable gas or liquid involved in the incident;
- condition (pressure, temperature, equivalent diameter) of the release;
- the location where the leaks occurs.

The following figures show the consequences of fires and explosions from major incidents where severe damage to the East Laydown area may occur.

- *Figure 7:* LNG handling/processing, covering liquefied natural gas and MRL (gas and liquid) rupture of, or major leak from, LNG lines; BLEVE or rupture of the smaller MRL vessels; and major leak from a MR vapour line at the MRL compressor. None of these scenarios are likely to impact the East Laydown area according to the established criteria in Table 1, causing a threat to occupants in this location.
- *Figure 8:* Natural gas handling and processing, covering scenarios associated with major leak of natural gas lines in processing areas and export line. Most of these scenarios are unlikely to impact the East Laydown area according to the established criteria in Table 1, causing a threat to occupants in this location. There is however a remote risk for impact on the Laydown area, as assessed in the risk analysis in Section 5.4.
- *Figure 9:* Extreme consequence scenarios associated with LNG tank rupture or major leak; natural gas line rupture; and BLEVE or VCE from the large MRL storage vessel. These scenarios may impact the East Laydown area according to the established criteria in Table 1, causing a threat to occupants in this location. The risk for impact on the Laydown area is assessed in the risk analysis in Section 5.4.

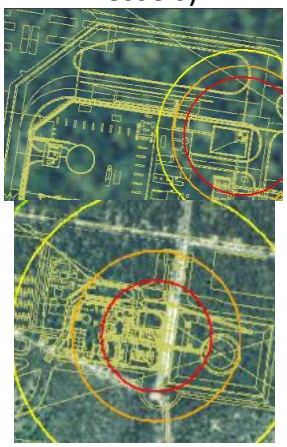
Figure 7: Scenarios associated with LNG handling and processing



MI-02: LNG tank bund sump fire

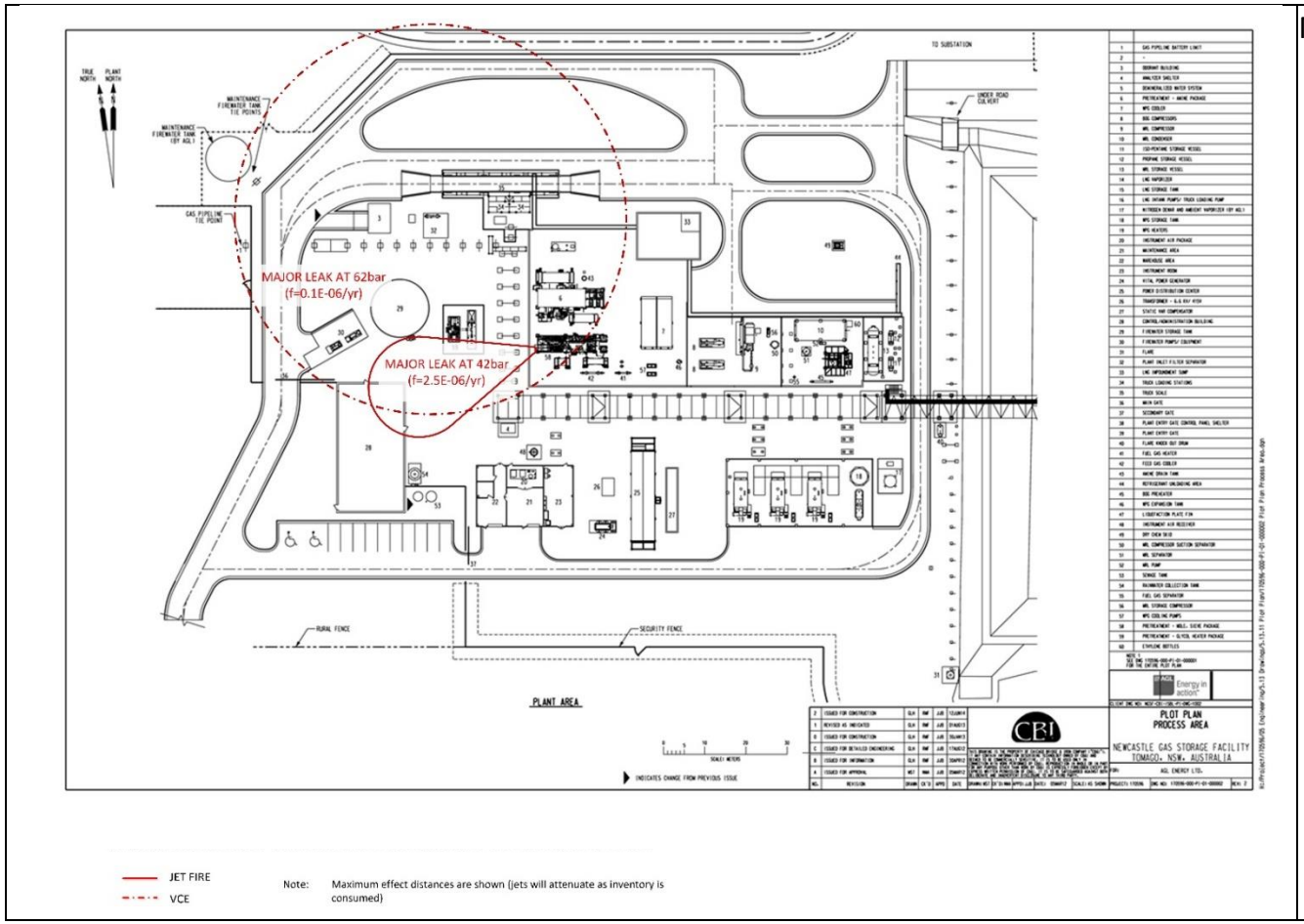
MI-03 Process area sump fire

MI-07 MRL/MR Gas incident (small MRL vessels)



Red circle is distance to 29kW/m^2

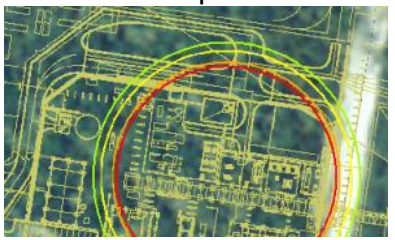
Figure 8: Scenarios associated with natural gas handling and processing



MI-04 Rupture 62MPa 250mm

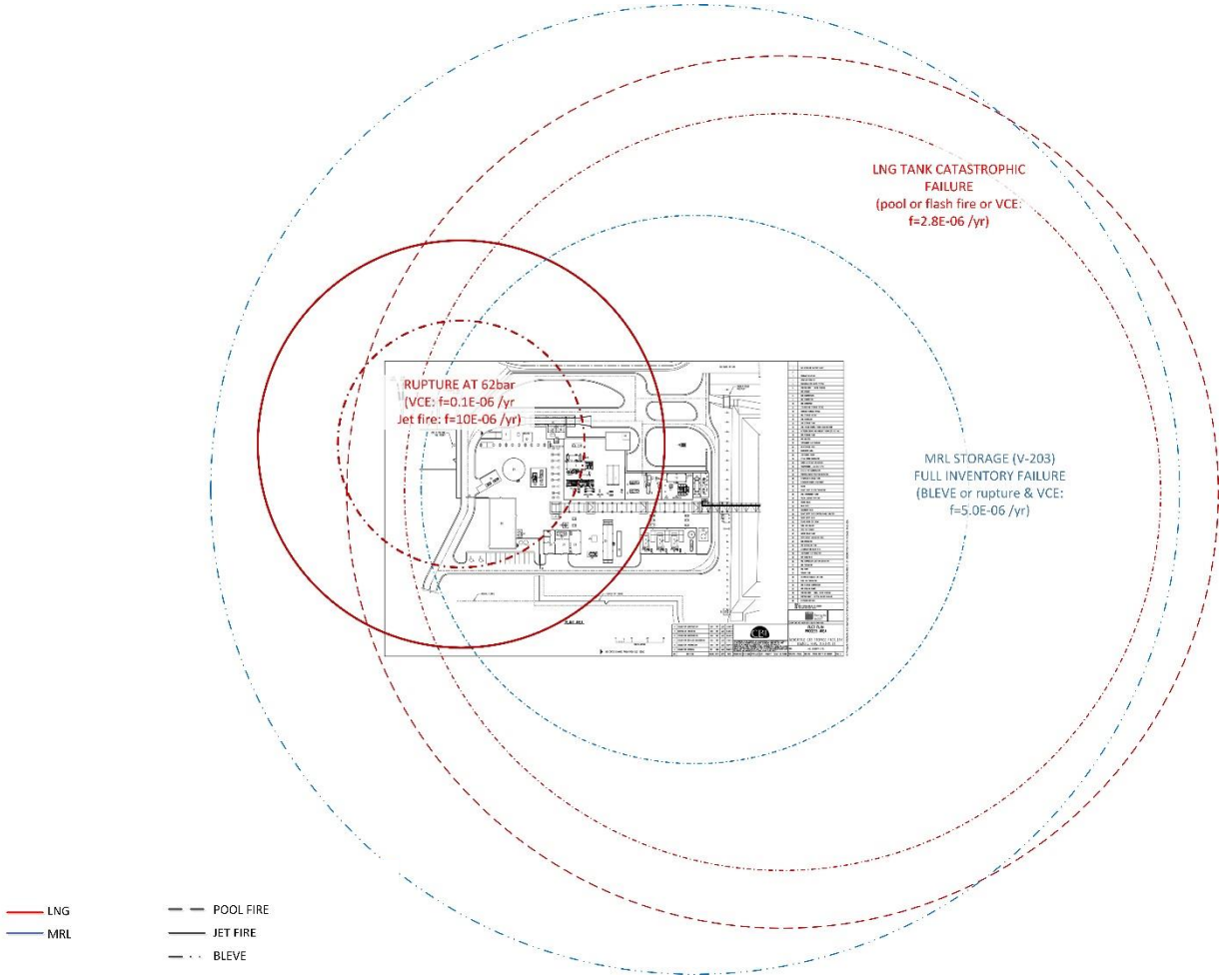
MI-04 Leak 62MPa 250mm

MI-05 Rupture / leak in medium pressure



Red circle is distance to 29kW/m^2

Figure 9: Massive scenarios (LNG tank rupture and high pressure natural gas pipeline rupture)



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5.4 RISK ANALYSIS

5.4.1 Likelihood analysis

The likelihoods of each incident scenario at the NGSF are assessed according to well established databases and entered into the Riskcurves® software (detailed in the FHA for the NGSF, in Ref 6).

5.4.2 Risk assessment and comparison with risk targets

Individual Risk:

- *Fatality:* The QRA prepared as part of the FHA for the NGSF (Ref 6) shows that the individual risk of fatality for a person located 24 hours per day, 365 days per year at the East Laydown area , is 2.2 x 10^{-6} per year (2.2 pmpy).

  This risk level is more than one order of magnitude lower than the NSW DPIE criterion of 50x10^{-6}/year which is generally regarded as acceptable risk level at a nearby industrial facility (Refs 1 and 4).

  Hence, the individual risk of fatality at the East Laydown area is significantly less than the fatality risk criterion for individual risk at a neighbouring industrial facility and is therefore considered negligible.

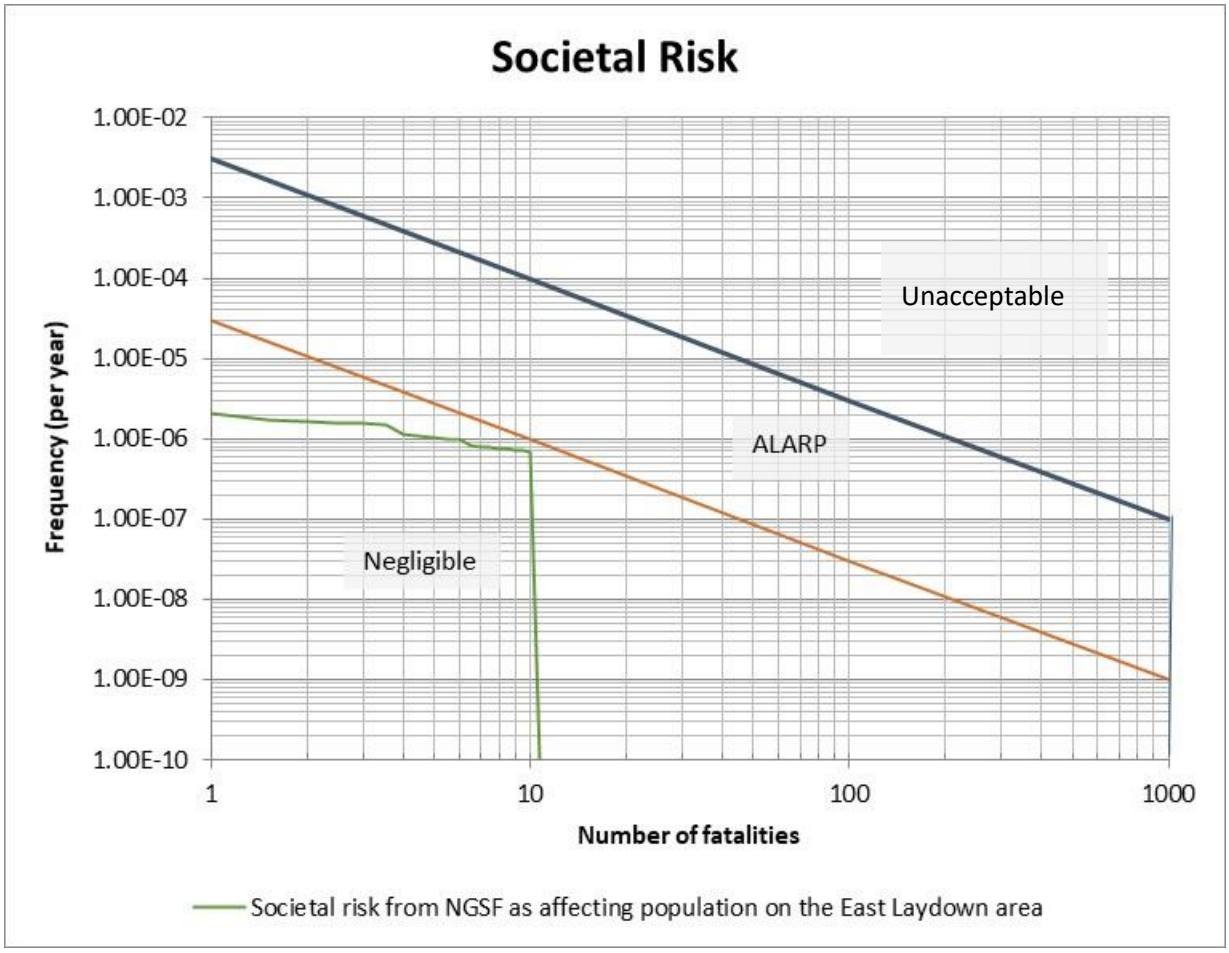
- *Injury:* The QRA prepared as part of the FHA for the NGSF (Ref 6) shows that the individual risk of injury for a person located 24 hours per day, 365 days per year at the East Laydown area, is 3.2 x 10^{-6} per year (3.2 pmpy).

  This risk level is more than one order of magnitude lower than the NSW DPIE injury risk criterion of 50x10^{-6}/year which is generally regarded as acceptable risk level at a nearby residential area (Refs 1 and 4). It is generally not applied to assess an industrial area.

Hence, the individual risk of injury at the East Laydown area is significantly less than the criterion for individual risk at a neighbouring residential area and is therefore considered negligible.

Societal risk: The societal risk calculations are presented in Figure 10 for the population at the East Laydown area as detailed in Section 2.2.3. These calculations include conservative estimates for occupancy, including 10 persons at the Laydown area during day shifts. With less conservative (more realistic) estimates the societal risk levels would be even further reduced.

Figure 10: Societal risk for fatality at the East Laydown area



5.5 RISK REDUCTION AND ALARP EVALUATION

The risk at the East Laydown area from the adjacent NGSF processing plant is below the applicable individual risk criteria for land use planning by more than one order of magnitude, and the societal risk falls within the zone defined as negligible in the NSW DPIE criteria (Refs 1 and 4).

By keeping the quantities of DGs and potentially hazardous/pollutant material at the East Laydown area, and the number of DG transports, to well below the thresholds in the NSW DPIE guidelines (Refs 3 and 5), the laydown area is not considered *potentially hazardous* according to SEPP33 and does not present *significant risk* in accordance with the multi-level risk assessment guidelines (Ref 5).

None of the activities proposed for the East Laydown area are potentially offensive as per SEPP33 (Ref 3).

Provided that the legal requirements, recommendations and commitments in Sections 6.1 and 6.2 are implemented, the risk of an incident at the East Laydown area affecting and initiating a major incident at the NGSF, and the risk of an incident at the NGSF affecting occupants at the East Laydown area, can be managed according to ALARP principles. This is consistent with the NSW DPIE's requirements for land use planning adjacent to potentially hazardous facilities in their HIPAP4 (Ref 1) and HIPAP10 (Ref 4).

6 CONCLUSION AND RECOMMENDATIONS

6.1 SUMMARY OF FINDINGS

The following commitments for the management of hazards and risks form the basis of the hazard and risk assessment of the East Laydown area:

1. The Safety Management System for the NGSF site, which includes the area proposed for use as the East Laydown, will form part of the overall control of the East Laydown area.

2. No potential liquid pollutants are to be stored at the East Laydown areas (i.e. no fuel, lubricants, oils, corrosive liquids etc.) and no packages containing environmental pollutant material.

3. The quantities of Dangerous Goods and other potential hazardous and/or pollutant material are to be held at well below the NSW DPIE SEPP33 and the multi-level risk assessment screening and the transportation of Dangerous Goods will be well below the SEPP33 *Transportation Screening Thresholds*.

4. All materials are to be stored as per manufacturer's recommendation, SDS requirements and any relevant Australian Standard and/or Codes of Practice.

5. No transfer of hazardous or pollutant liquids will occur at the East Laydown area.

The results of the Planager assessment demonstrate that East Laydown area is not *potentially hazardous* or *potentially offensive* or associated with *significant risk* as per the definitions in SEPP33 and the Department of Planning, Environment and Industry's multi-level risk assessment. Further, the risk of pollution at the Tomago sand beds is kept to a minimum.

The location of the East Laydown area is considered acceptable from the point of view of adherence to the risk criteria applicable for the NGSF and following ALARP principles, as follows:

Table 8: Summary of the assessment

Aspect of assessment	Requirement	Adherence?
Individual risk of fatality	Risk level at an adjacent industrial area must be below $50x10^{-6}$/year (NSW DPIE, Ref 1, 4)	The individual risk of fatality for a person located 24 hours per day, 365 days per year at the East Laydown area, is 2.9 x 10^{-6} per year (2.9 pmpy). This is significantly less than the criterion for industrial areas of 50 x 10^{-6} per year (50pmpy) and the criterion for individual risk of fatality at the East Laydown area is complied with.
Individual risk of injury	Risk level at an adjacent residential area must be below $50x10^{-6}$/year (NSW DPIE, Ref 1)	The individual risk of injury for a person located 24 hours per day, 365 days per year at the East Laydown area, is 1.8 x 10-6 per year (1.8 pmpy). This is significantly less than the criterion for residential areas of 50 x 10^{-6} per year (50pmpy) and the criterion for individual risk of injury at the East Laydown area is complied with.
Societal risk	Risk levels to be kept within negligible area or ALARP must be satisfied	The societal risk for the occupancy at the East Laydown area is within the negligible risk zone and the criteria for societal risk of fatallity at the East Laydown area is complied with.
ALARP evaluation	The consideration applies to whether a degree of risk increase can be seen as negligible considering its benefits	There is minimal impact on then risk profile at the NGSF associated with the proposed East Laydown area. A number of recommendations have been made to further reduce the risk from the Laydown area to the NGSF and vise versa, including ensuring that the East Laydown area is managed to below SEPP33 threshold limits with no storage of pollutant material and, as such, is not considered *Potentially Hazardous.* Further, a number of risks have been eliminated including ensuring no liquid pollutants to be held at the Laydown area. These efforts, together with the adherence to all relevant risk criteria for land use planning, combine to ensure that ALARP principles are met as per NSW DPIE requirements.

6.2 RECOMMENDATIONS

The following recommendations ensure that the risk at the East Laydown area is managed in accordance with ALARP principles:

Table 9: List of recommendations

Recommendation 1: The NPS Project will need to determine the means with which people accessing the East Laydown area will enter and exit the site at the security gate at Old Punt Road.
Recommendation 2: As the NGSF carpark area can be accessed from the forest tracks surrounding the site, security of the East Laydown area will need to be determined.
Recommendation 3: To ensure that the proposed East Laydown area does not compromise security at the NGSF the NPS Project will need to develop a Security Plan for the East Laydown area and this Plan is to be integrated with the NGSF Security Plan.
Recommendation 4: Regular inspection of the East Laydown area.
Recommendation 5: A Spill/Loss of Containment (LOC) Control Management Plan to be developed for all potentially hazardous/pollutant chemicals to be stored on-site, with spill kits available. In case of a spill, personnel at the East Laydown area to be trained in spill response and, if needed, in initiating the emergency response procedure.
Recommendation 6: Emergency response plan (ERP) applicable for the East Laydown area to be developed and to be integrated with the NGSF ERP.
Recommendation 7: Tactical Fire Plan or other info in the ESIP to be developed for the East Laydown area as per NSWFR requirements.
Recommendation 8: WHS risks to be managed under the NGSF requirements for WHS Management (note that this requirement forms part of a Conditions of Consent for the NGSF site, not just inside the processing area). This needs to include processes such as site Induction, verification and approval of contractor's WHS systems, Management of Change, Permit To Work.
Recommendation 9: The underground high and low pressure natural gas pipelines at the northern side of the site to be physically separated (/secured) from East Laydown area, to ensure any weight or vibrations at the underground pipelines is duly managed. Suitable offset to be determined, identified and managed.
Recommendation 10: The emergency alarm at the NGSF will need to be audible also att the East Laydown area to alert persons at the East Laydown of the need to evacuate from the site in case of an emergency at the NGSF.
Recommendation 11: The applicable Asset Management Zone between East Laydown area and surrounding bushland to be determined to minimise risk of a bush fire.

7 REFERENCES

1 NSW Department of Planning and Infrastructure, Hazardous Industry Planning Advisory Paper No 4 *Risk Criteria,* January 2011

2 NSW Department of Planning and Infrastructure, Hazardous Industry Planning Advisory Paper No 6 *Guidelines for risk analysis*, January 2011

3 State of NSW, Department of Planning, *Applying SEPP 33, Hazardous and Offensive Industry Development Application Guidelines*, 2011

4 NSW Department of Planning and Infrastructure, Hazardous Industry Planning Advisory Paper No 10, *Land Use Safety Planning,* January 2011

5 Department of Planning and Infrastructure, *Multi-level Risk Assessment*, 2011

6 Nilsson K, *Final Hazard Analysis Newcastle Gas Storage Facility Project in Tomago, NSW - Phase 4*, Planager Pty Ltd, 25 September 2015